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Exercise Read about the *Low Orbit Ion Cannon* (LOIC)

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This was *DNS amplification* attack: the subverted devices make DNS lookup requests to servers with a reply address forged to that of the victim

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There are similar flooding attacks using other public services (such as time servers (NTP) and directory servers (LDAP)) exist

Security

“The ’S’ in IoT stands for security”

Anon

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Implementation attacks

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Some hosts were vulnerable to oversized ping packets: the *Ping of Death*

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The usual result is a crash: another denial of service

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Modern implementations check sizes are sensible before trying to reassemble fragments

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You might ask how there are still bugs like this in modern operating systems?

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Again, implementations need to timeout and drop old fragments

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- Jolt (aka sPING): fragmented ICMP packets
- Land attack. The source addresses on TCP SYNs are the same as the destination. The server tries to respond to itself
- Teardrop. Overlapping fragments cause problems on reassembly

Security

- New Teardrop (aka Bonk, Boink, Teardrop2). Overlapping fragments on a UDP packet reassemble to form a packet with an invalid header
- Zero length fragments. In some implementations these were stored but never used. Thus storage was exhausted
- And so on

Making a robust implementation is very hard!

Social Engineering Attacks

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Often this is much easier than a machine attack

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- Anything else to unbalance them or get their sympathy

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- Pretend to be a supervisor and threaten to sack them if they do not comply
- Pretend to be a distraught user who has lost their password
- Anything else to unbalance them or get their sympathy

This is much easier than trying to crack a password by brute force

Social Engineering Attacks

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This is a form of impersonation to try and convince the user to hand over valuable information, such as credit card numbers

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- The page looks plausibly like the bank's
- The victim enters their details and sends them off
- The email and Web page are fakes, so now the details are in the hands of criminals

Social Engineering Attacks

Similarly for many other attacks, such as The *419* or *Nigerian* fraud named after the South African police code used to identify this approach

Exercise Read about these

Firewalls

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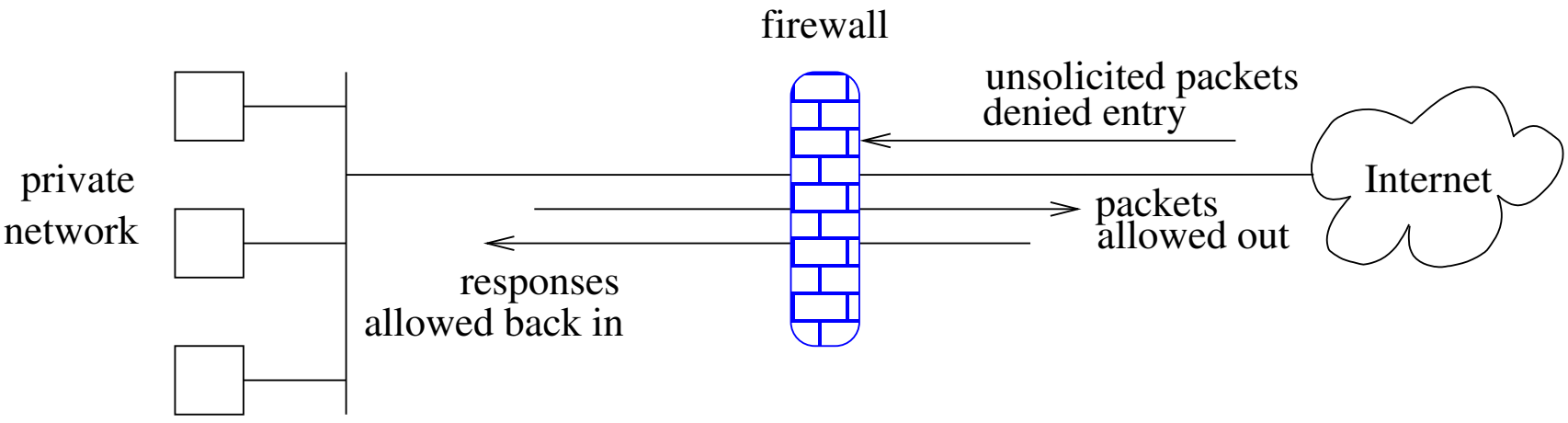
A *firewall* is a router/gateway that sits between a private network and the wider Internet and tries to protect the private network from attacks

It might be an ordinary router running firewall software, but specialised firewall hardware also exists

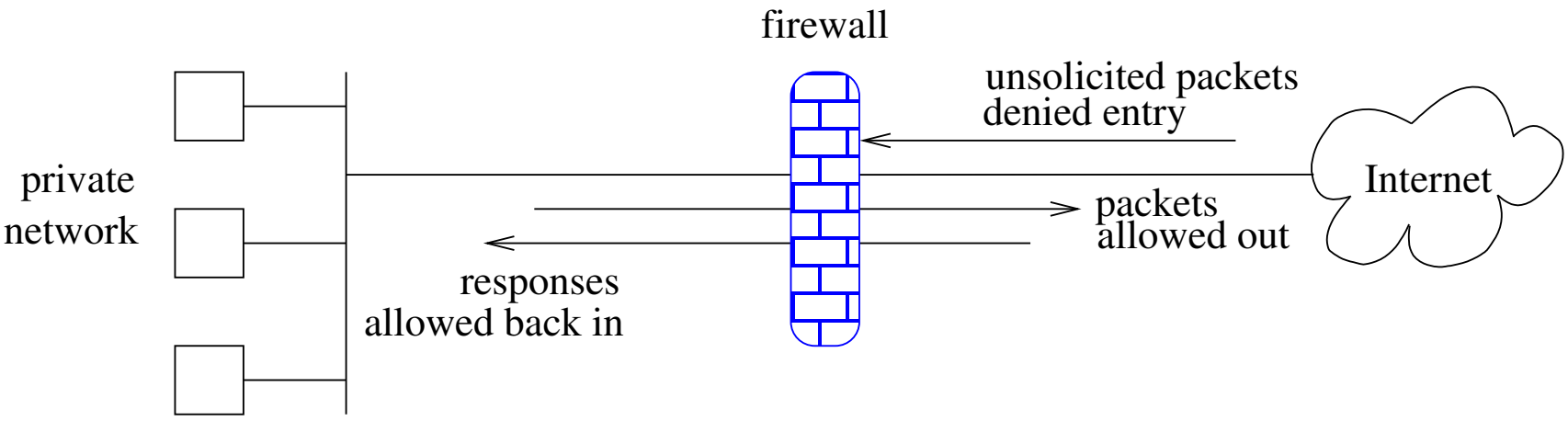
Firewalls



Firewall monitoring packets

The firewall inspects each packet as it enters and decides what to do with it. It might:

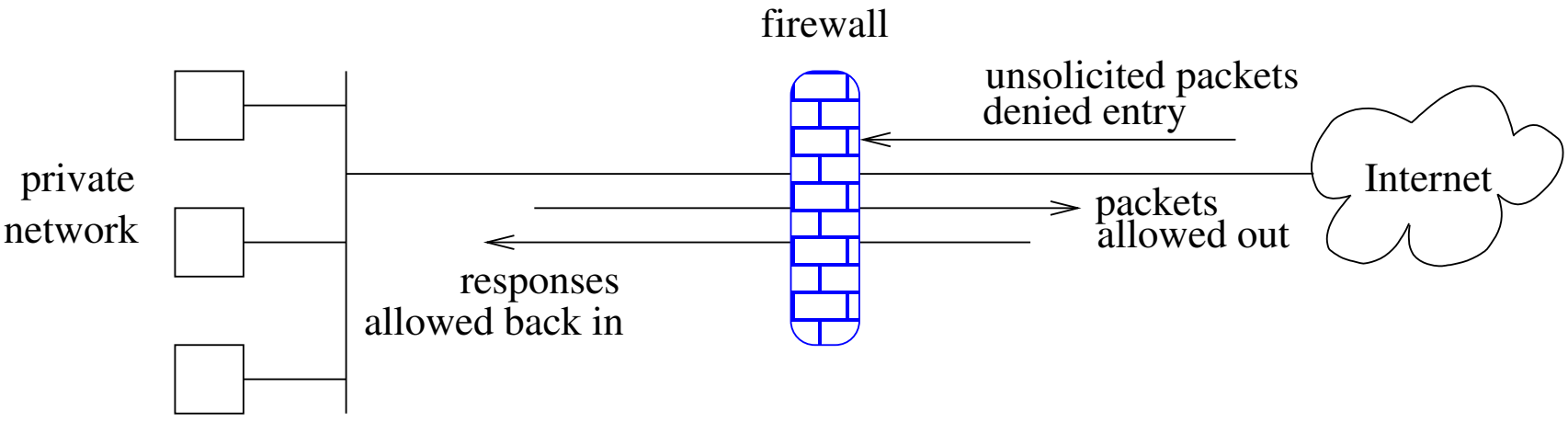
Firewalls



Firewall monitoring packets

Pass the packet through unchanged;

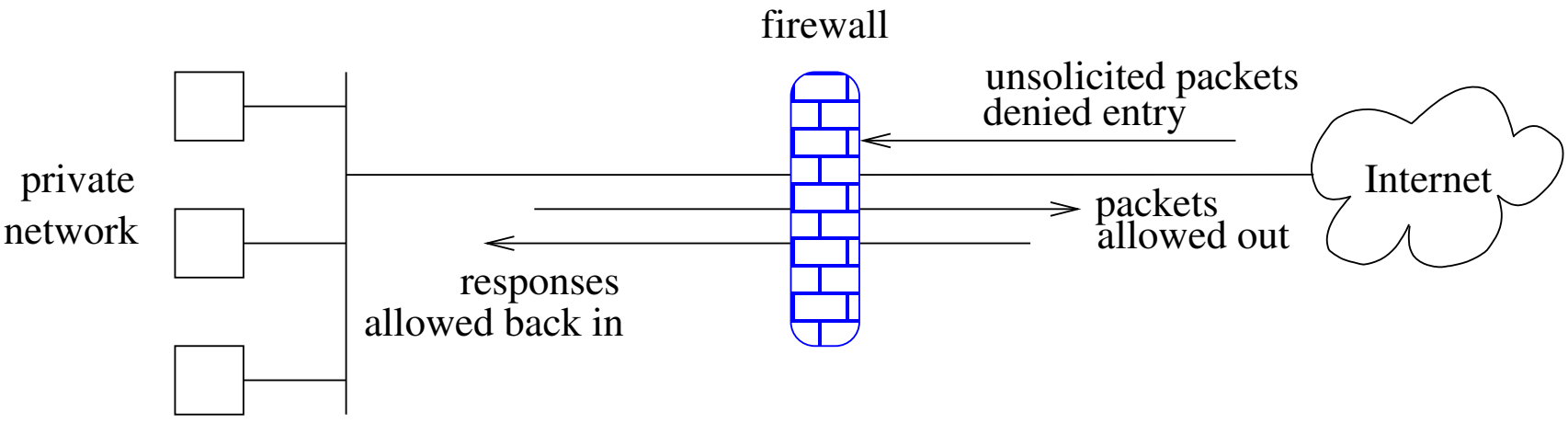
Firewalls



Firewall monitoring packets

Pass the packet through, but modified in some way, e.g., with the TOS bits changed or addresses changed with NAT;

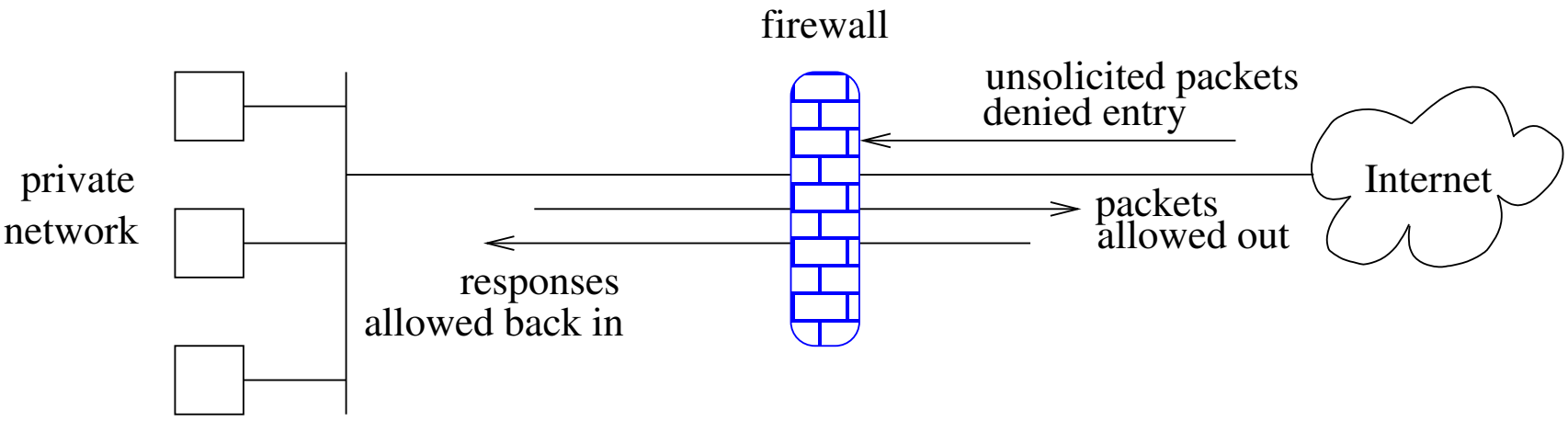
Firewalls



Firewall monitoring packets

Drop the packet and send an ICMP back, e.g., “port unreachable”;

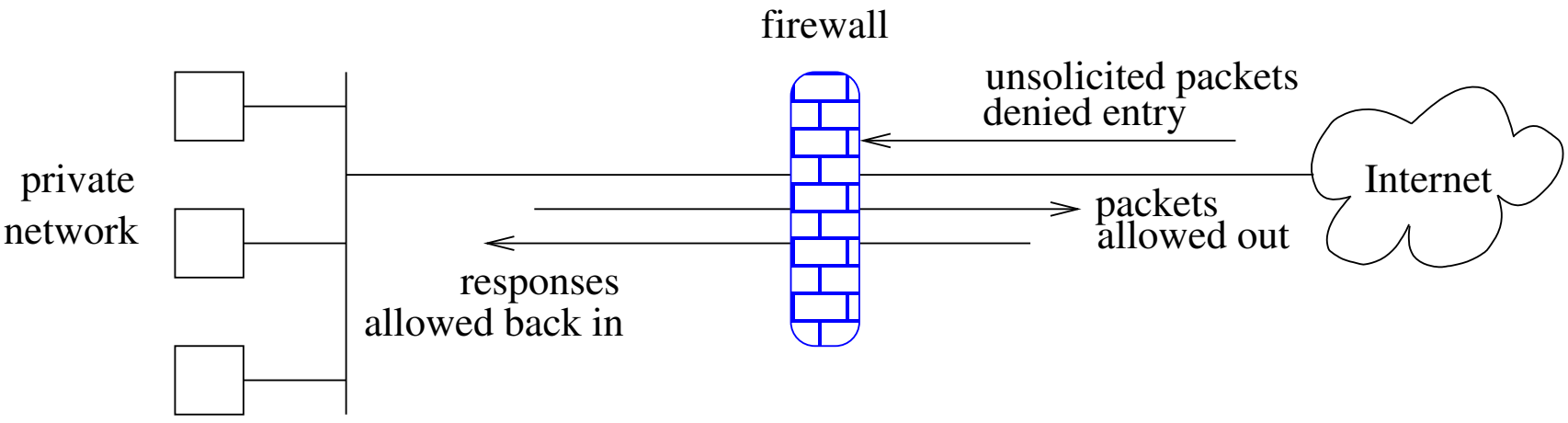
Firewalls



Firewall monitoring packets

Silently drop the packet;

Firewalls



Firewall monitoring packets

Or many other possibilities

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Exercise Learn about scanning tools like `nmap`

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- *packet filters* work in the data link, network and transport layers at the individual packet level, making decisions based on protocol (TCP or UDP, etc.), source and destination addresses, port numbers, TOS bits and so on
- *application layer* firewalls work in the application layer and can use information that the applications use, e.g., HTTP filters can make decisions at the Web page level

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- *application proxies* which also work in the application layer and act as an intermediate between the application and the server. They can also make use of application layer information

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A Web proxy for an institution might receive all HTTP requests from host within the organisation and choose to relay them onwards, or not, based the details of the HTTP request

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Of course, you can combine things: have a packet filter transparently rewrite packets to the Web to go via a proxy

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Of course, NAT works nicely alongside firewalling

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Public wireless networks often block outward port 25 (SMTP) to prevent users sending spam

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Capturing the many and varied requirements of a network is subtle and easy to get wrong

Firewalls

Exercise Some attacks get through the firewall by using a phishing attack to get a user to download and run some code. This code can then reach outwards through the firewall. Read about this

Exercise Some firewalls are configured to let in some traffic. For example, allowing an external connection to a security camera, so that you can remotely view your home. But if you can connect, so can others. Read about this

Exercise Some appliances, e.g., security cameras, connect outward to servers so that you can remotely view via the server. But if you can connect, so can others. Read about this

Security and Authentication in IP

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We need both security (encryption) and authentication

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- Network. At this layer we have IPSec, also described shortly
- Data link. We can have encryption even in the data link layer. E.g., WPA is used to obscure wireless communications